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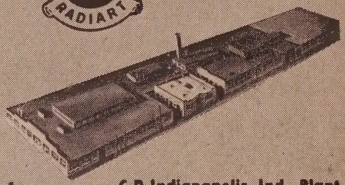

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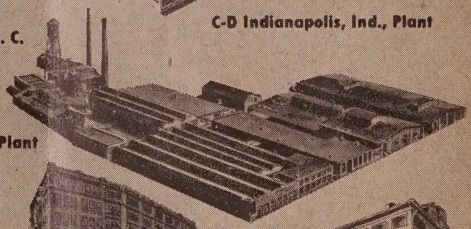

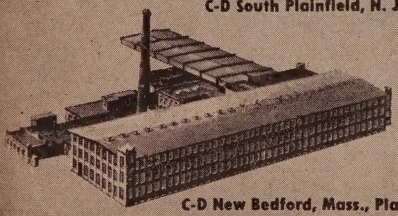

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Vol. 17 JANUARY, 1952 No. 1

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SIMPLIFIED OSCILLOSCOPE VOLTAGE CALIBRATOR

Within a comparatively short time, the **oscilloscope voltage calibrator** has become established as an important accessory instrument. This device enables quick checking of voltages represented by patterns on an oscilloscope screen. The calibrator provides considerably more latitude and versatility than can be obtained with an individual oscilloscope screen calibration, since the latter must be provided for a multitude of separate settings of the oscilloscope gain controls. The *calibrator* allows voltage measurements at any setting of the controls and at any time without respect to aging of 'scope components or loss of gain. The calibrator is particularly attractive to the television service technician who now is called upon for the first time to check peak-to-peak voltages of the complex television waveforms.

A number of constructional articles have featured oscilloscope voltage calibrators which generate square waves or clipped sine waves for measuring purposes. The merits of the circuits employed are well known and are recognized here. However, it is entirely possible to use a line-frequency sine-wave measuring signal and to construct a simple, inexpensive calibrator with sine-wave output. No tubes are needed.

The technique employed in making voltage checks with the calibrator consists of first noting on the ocsilloscope screen, the vertical height of the signal waveform under study; and then substituting the signal from the calibrator, adjusting the calibrator output until the measuring signal has the same height. The peak-to-peak voltage value of the measuring signal then is equal to the peak-to-peak value of the "unknown" signal and may be read directly from the scale of the calibrator output control. The popularity of the flat-topped (square-wave or clipped sine-wave) signal for calibration purposes is due to the fact that the top and bottom of this sort of pattern are horizontal and easily lined up with lines on the oscilloscope screen. But this obvious advantage is lost in many home-constructed instruments, and in some factory-built models as well, because of the tendency of the "horizontal" top and bottom to tilt and thus introduce confusion as to the correct peak value.

When a sine-wave test signal is employed, there is no doubt regarding

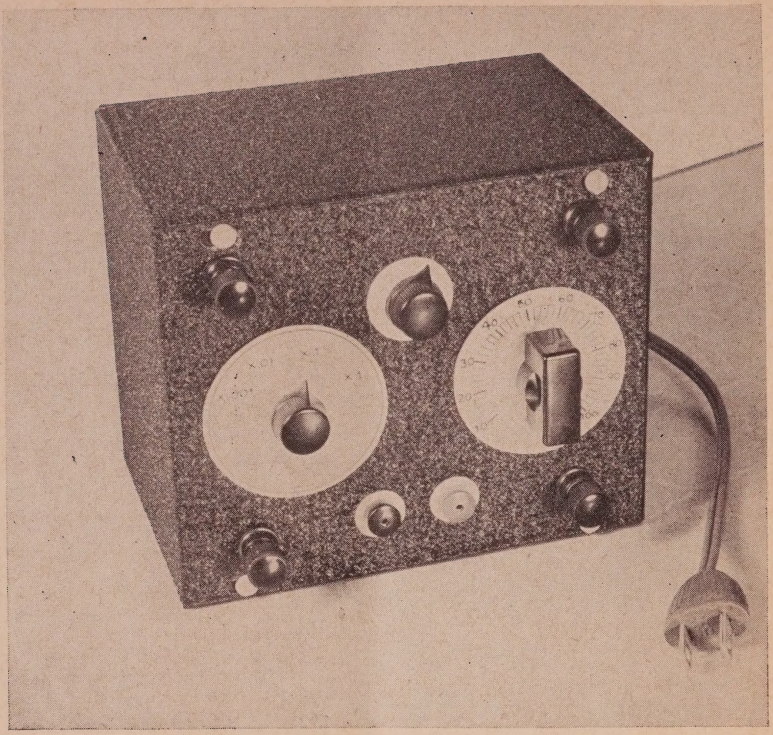

Fig. 1. The completed oscilloscope voltage calibrator. (See Fig. 3.)

the highest points of both its positive and negative peaks. The point of intersection of these test peaks with the horizontal lines of the oscilloscope screen are discerned readily. The calibrating signal is obtained easily from the a. c. power line through a step-down transformer and calibrated voltage divider.

Figure 4 shows the three principal types of test patterns obtained with sine-wave calibration signals. In Figure 4A, the oscilloscope sweep frequency, which has been set previously for proper reproduction of the waveform under study, is low enough to display one or a few cycles of the calibrating voltage. Unless these cycles are spread very broadly across the screen, little difficulty will be experienced in determining the exact point at which the tips of the positive and negative peaks touch the horizontal reference lines of the oscilloscope screen. In Figure 4B, the sweep frequency is much higher than the power-line frequency, and the calibration pattern takes the form of a luminous band or rectangle. Here again, there can be no doubt as to the top and bottom of the pattern. If any difficulty should arise regarding exact identification of the sine-wave peaks (Figure 4A), the oscilloscope sweep may be switched-off temporarily. When this is done, the calibration pattern becomes a sim-

ple vertical line (See Figure 4C), the length of which may be adjusted readily to correspond to the overall height of the pattern under study. In each pattern shown in Figure 4, the overall height is equal to the peak-to-peak voltage value indicated by the calibrator output attenuator.

Figure 2 shows the complete circuit of the simplified calibrator. This arrangement will be recognized as a simple combination of step-down transformer, calibration control, and output attenuator.

Approximately 57 volts a. c. are derived from the a.c. power line through the step-down transformer (T). This latter unit might be any suitable small-sized transformer having 115 volts input and 50 to 60 volts r. m. s. output. However, we found that an interstage audio transformer, having a 2-to-1 turns ratio, was satisfactory for this low-current application. The transformer shown in Figure 2 is a U. T. C. Type S-2 with half of the secondary winding connected to the power line.

The output attenuator system consists of a coarse control (S_2) and a continuously-variable fine control (R_2). The fine control permits smooth variation of the output voltage from its maximum value to 1/10 maximum. The coarse control multiplies any voltage setting of the fine control by 1, 0.1, 0.01, or 0.001. In the lowermost position of the coarse control S_2, the signal under study (connected to input binding posts B_3 and B_4), instead of the calibrating voltage, is connected straight through to the output binding posts. A standard voltage of 35.4 volts r. m. s. is applied to the top of control R_2. This voltage value is set by means of calibration control R_1 and an a. c. voltmeter connected tempora-

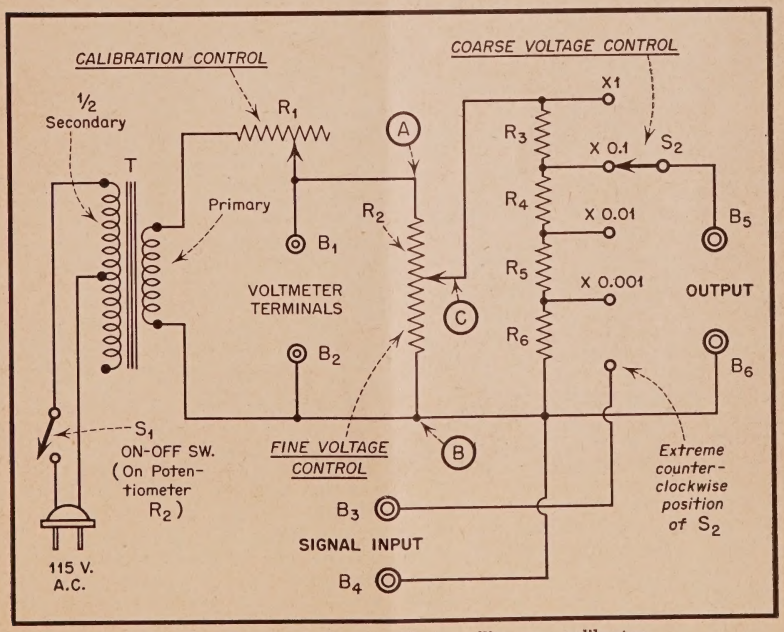

Fig. 2. Circuit of the simplified oscilloscope calibrator.

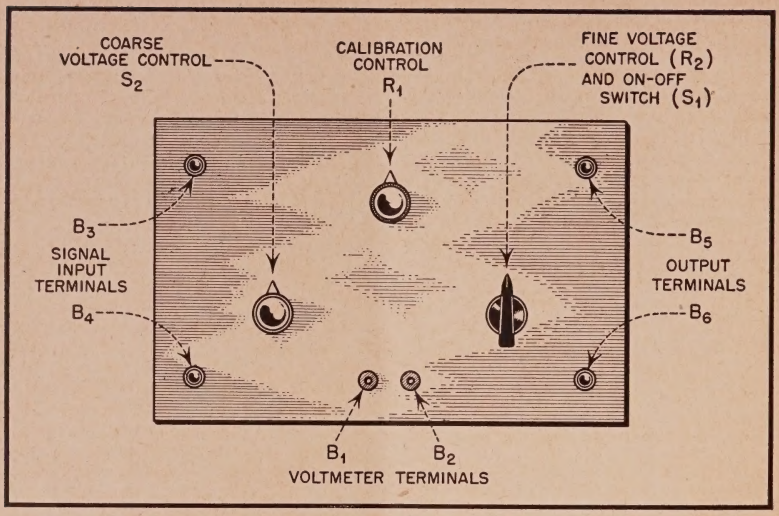

Fig. 3. Front-panel layout.

rily to pin jacks B_1 and B_2. The 35.4 v. potential is equal to 100 volts peak-to-peak. (Volts peak-to-peak = r.m.s. volts × 2.83). The maximum calibrating voltage output thus is 100 volts peak-to-peak. Output binding post terminals B_5 and B_6 are connected to the vertical amplifier input terminals of the oscilloscope.

Figure 1 shows external arrangement of the calibrator. The controls and terminals seen in this photograph may be identified by reference to the layout sketch Figure 3. Each component has been located for operating convenience.

The instrument is built into a standard metal radio utility box, 6″ long, 5″ high, and 4″ deep. The two direct-reading scales are made of white cardboard, lettered in India ink, and after graduation are covered with transparent plastic discs to prevent soiling.

Note, from Figure 1, that the scale of the fine control (right-hand side of the panel) does not cover the entire arc of travel of potentiometer R_2, but goes down only to 10 percent of the total rotation. This is because accurate setting usually cannot be made lower than about 1/10 of full-scale.

The multiplier switch (coarse control) is mounted on the left-hand side of the front panel between the signal input binding posts. In its extreme counterclockwise position, this switch makes contact with the lowermost point shown in Figure 2. This position is not marked on the scale seen in the photograph. At this setting, switch S_2 connects the signal under study directly from the upper signal *input* binding post to the upper *output* post. Both lower binding posts are connected together permanently. With the signal transfer position placed at the extreme counterclockwise setting of switch S_2, protection is provided because switch rotation must be started at its lowest-voltage position.

The ON-OFF power switch, S_1, is attached to the fine control potentiometer, R_2, and is actuated when the control is in its extreme counterclockwise position. This arrangement provides safety also, since the power may

be switched-on only with control in its lowest calibration-voltage position.

No special techniques are required in the layout or construction of the calibrator, since the circuit is not complex. However, the signal lead from binding post B_3 should be spaced well away from the interior wall of the instrument case and should be run straight and direct to switch S_2. In the same manner, the lead from switch S_2 to binding post B_5 should be run straight and kept separated from the metal case. These precautions are aimed to minimize stray capacitance and stray pickup which become important when the test signal has a relatively high frequency.

Initial Adjustment

Resistors R_3 to R_6 must be selected carefully to have the exact ohmic values specified. Note that the odd values required for R_3, R_4, and R_5 are obtained in each case by connecting two suitable resistors in series. If the reader's budget permits, precision resistors may be employed in each of the six positions for greatest accuracy.

Before control R_2 is connected into the circuit, it should be secured to the panel with its blank scale and calibrated in the following manner: (1) Connect a source of accurately-known 10 volts a. c. to the ends of R_2 (points A and B in Figure 2). (2) Connect an a. c. vacuum-tube voltmeter (set to its 0-10-volt range) to the output terminals of R_2 (points B and C in Figure 2). (3) Reduce the setting of R_2 until the v. t. voltmeter reads exactly 9.8 volts. Mark this setting in pencil on the blank scale. (4) Reduce R_2 until a meter reading of 9.6 volts is obtained. Mark this point on the scale. (5) Repeat the procedure at each lower 0.2-volt reading of the meter, marking each corresponding point on the blank scale. Make the last calibration at 1 volt. (6) The 1-volt point is marked 10 on the scale, 2 v. marked 20, 3 volts 30, etc. The 10-volt point (maximum setting of R_2) is marked 100. (7) After this procedure is completed, remove the scale and ink-in the

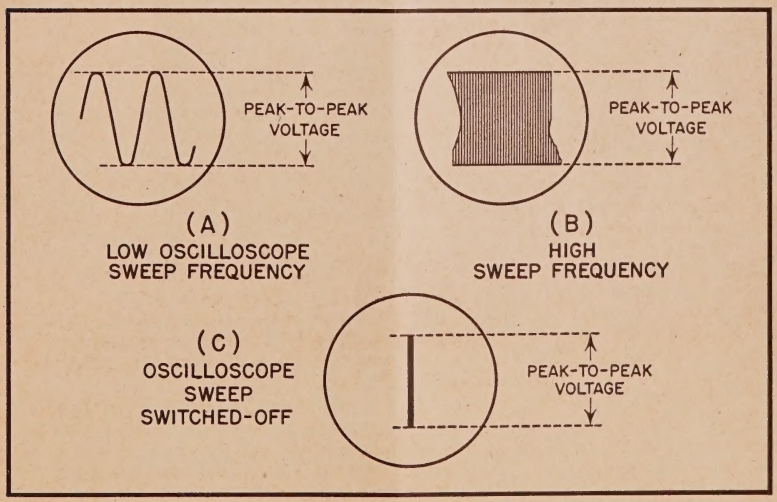

Fig. 4. Patterns obtained with oscilloscope calibrator.

check points and numbers. Then re-install the potentiometer and scale and connect the potentiometer into the circuit.

Prepare the scale for switch S_2 to read 1, 0.1, 0.01, and 0.001, as indicated in Figures 1 and 2.

After the instrument is completely assembled and wired, set the calibration control (R_1) in the following manner: (1) Connect an a. c. vacuum-tube voltmeter (set to its 0-100 v. range) to pin jacks B_1 and B_2. (2) Switch-on the calibrator and set calibration control R_1 to bring the meter exactly to 35.4 volts. The calibrator now is standardized and the voltmeter may be removed from the circuit. The v. t. voltmeter has very high input resistance and does not introduce appreciable loading. Performance of the calibrator accordingly will be the same with and without the meter in the circuit. If, on the other hand, a low-resistance a. c. voltmeter (such as a 1000 ohms-per-volt instrument) is used for the standardization, this meter must be left connected to the calibrator, since the output of the calibrator will not be the same when the meter is disconnected.

Using the Calibrator

For the benefit of those readers who have not yet used an oscilloscope voltage calibrator, the following explanation is offered. (1) After standardizing the instrument in the manner explained in the preceding Section, plug the calibrator into the power line but with the power switched-off. (2) Connect binding posts B_5 and B_6 to the vertical amplifier input terminals of the oscilloscope. (3) Set coarse control S_2 to its extreme counterclockwise (signal transfer) position. (4) Connect the source of signal under study to binding posts B_3 and B_4. (5) Adjust the oscilloscope controls for a suitable pattern height, noting the horizontal lines of the oscilloscope screen which mark the top and bottom of the pattern. (6) Switch-on the calibrator and adjust the coarse and fine controls (S_2 and R_2) to bring the test pattern to the same height as the original signal pattern, using one of the schemes illustrated in Figure 4. At this point, read the peak-to-peak voltage from the settings of R_2 and S_2.

PARTS LIST

B_1, B_2—Insulated pinjacks for external a. c. voltmeter

B_3, B_4, B_5, B_6—Insulated binding posts

R_1—10,000-ohm wirewound potentiometer

R_2—25,000-ohm wirewound potentiometer with switch (S_1)

R_3—90,000 ohms 1 watt (50,000- and 40,000-ohm resistors in series)

R_4—9,000 ohms 1 watt (5,000- and 4,000-ohm resistors in series)

R_5—900 ohms 1 watt (500- and 400-ohm resistors in series)

R_6—100 ohms 1 watt

S_1—S. p. s. t. switch installed on potentiometer R_2

S_2—Single-pole, 5-position, non-shorting, rotary selector switch

T—2-to-1 interstage audio transformer (U. T. C. Type S-2.)

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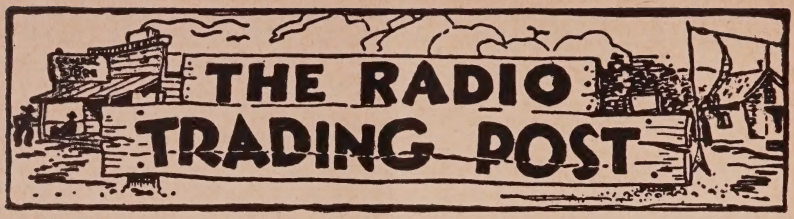

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FOR SALE—Hickok: Model 550X Dynamic Mutual Conductance and Multitester, Model 177X sig. gen., both in matching cases, excellent. Also portable tube tester type KMO 175-60. All for $195. Mancuso Motors, Inc., 214 East Main St., Batavia, New York.

SELL—QST's 1927 thru 1948; 17" TV chassis; meters; Weston photocell No. 594; Meissner B.C. tuner; tubes, parts, etc. Want antique or modern guns, swords, rifles, etc. Robert Schill, 3619 Carrolton Ave., Wantagh, L. I., N. Y.

FOR SALE OR TRADE—14" Admiral TV plastic cabinet with mask, cord, and built-in ant.; Regency booster; 16" transcriptions with music. Also aluminum disc good for recording on one side. Want air pistol, tube checker. Galen Stutzman, Rt. 2, Adrian, Mich.

WANTED—Gear that moves the recording head up and down in the Majestic combination wire recorder Model 7YR753. John A. Williams, Sedalia, Colo.

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FOR SALE—Hammarlund "Four-20" transmitter with built in VFO and "Four-11" modulator. Included are 10, 20, 40, and 80 meter coils, switch and instructions with schematics. In excellent condition. $50 plus shipping. Edward A. Spacek, 311 East 70th St., New York 21, N. Y.

FOR SALE OR TRADE—Supreme tube and bat. tester 389A, $35; T10B Transmit tuning unit, $5; several test instruments. Want 5" scope. W. F. Onder, Box 330, Arnold, Mo.

SWAP—HRO communications receiver, with 2.5 volt tubes, power supply and coils, in fine working condition. Want 35mm camera, press camera, or what have you? P. A. Romanchuk, 7825 Bergenline Ave., North Bergen, N. J.

FOR SALE—Scott 111A Dynaural noise suppressor, new cost $29.99, six months old, sacrifice first $12.50. Will consider tweeters in trade. James H. Littig, Box 203, Kasota, Minn.

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FOR SALE—Howard Sams vols. 1 to 4, $26. Riders vol. 12 $8. AM sig. gens., Precision E200, $35, Clough-Brengle, $15, Test-Rite portable, $10. 7DP4 - 7EP4 CR tubes, $7 ea. Sam Mitchell, 671 E. 7th St., Brooklyn, N. Y.

FOR SALE—Sams Photofacts vol. 6 thru 14, complete with binders, labels attached, and index. Finest condition. Will ship c.o.d. on receipt of M.O. or certified check for $100. Chuck's Radio, Box 75, Madras, Oregon.

FOR SALE—AM tuner, RF stage, xfmr. operated, needs alignment, $10. A. D. Doll, Box 150, Park Falls, Wisc.

WANTED—Good signal tracer. Will buy or trade other parts. Sadler Radio, Clayton, New Mexico.

FOR SALE—Recording wire, magnetic, stainless steel (.0036) high quality, bulk quantities only, $9 per pound, approx. 23 hours per pound. Mr. R. R. Biermann, 104-17 Farmers Blvd., Hollis, Long Island, New York.

FOR SALE—Meissner FM 8 tube tuner, model 8-C. Had it around 2 years and never sold it. Paid $38. Best offer takes it. Sam Fiorino, 8 West Main St., DuQuoin, Illinois.

FOR SALE—Custom push-button car radios for Chevrolet, Buick, Pontiac, Hudson, etc., $55.20. Cherry Radio Co., 1438 Belfield Ave., Philadelphia 40, Pa.

WANTED—War surplus radio, radar, sonar, Loran, and test equip. Trade or cash. T. Clark Howard, 46 Mt. Vernon St., Boston 8, Mass.

FOR SALE—Square D, Wigginton voltage tester, 600 volts, a.c.-d.c., A-1 cond., correct indication. $5 postage paid. Frank Kimble, 1111 Forrester St., Albuquerque, New Mexico.

WANTED TO BUY—TV receiving tubes. Send list with best prices. John C. Zilinsky, 629 E. Sixth St., South Boston 27, Mass.

SWAP—85 bass accordion in excellent condition and NRI sig. tracer. Want a receiver and transmitter of known make. No obsolete or surplus equip. Charles J. Tucci, 47-24 98th Pl., Corona 68, N. Y.

WANTED—Any back issues of the Electrical experimenter magazine from 1913 to 1920. Leland I. Anderson, 127 Seymour Ave. S. E., Minneapolis 14, Minn.

WANTED—F.C.C. approved Citizens Band trans. and receiver. Give price. Also want amplifier and contact mike for guitar. Island Musical Shop, 2025 Mermaid Ave., Brooklyn 24, N. Y.

SWAP—LM 7 frequency meter for a.c. operation for 8mm camera with an f2.7 or better lens. Also desire projector. Have other electronic equip. on hand. Morris Tischler, 4600 Norfolk Ave., Baltimore 16, Maryland.

SELL—Allied 16" recorder. Overhead feed, 112 lines/inch, inside out, 33-1/3 or 78 r.p.m., with astatic B-16 pickup arm and G.E. RPX-050 cartridge, in case, $125. Also 18" PM speaker, $35 and Jensen JHP-52, $15. Prefer locals. D. Pace, 564 Audubon Ave., N. Y. C. 33, N. Y.

FOR SALE—N.R.I. service manual, vol. 2, containing diagrams of receivers built during 1946-1949, $10; N.R.I. combination tester No. 1175 B, $35; tubes. Want radio for 1949 Ply. deluxe auto. N. J. Nelson, Mahnomen, Minn.

SWAP—Shur model 708A crystal mike, telescope floor stand; G.E. S-1203D 12" speaker with walnut baffle. Want Hallicrafter S-38B or National SW54 receiver. Walter A. Larsen, 309 George St., Hanover, Pa.

BUY, SELL, OR SWAP—Radio and TV tubes. Send your list in exchange for ours. Also swap condensers for tubes. Andrews, 740 Maple St., Bethlehem, Pa.

FOR SALE—Lionel train accessories; Universal tube checker; Lafayette 50 watt PA system, 3 speakers, 1 mike. Reasonable. Joseph Harrison, 304 - 3rd St., Albany, N. Y.

FOR SALE OR TRADE—Bound vols. of QST magazines. Bound in hard covers. Excellent cond. Have years 1926, 27, 28, 30. Eight volumes in all. Bound two volumes for each year. George Novak, 5036 So. Kildare, Chicago 32, Ill.

FOR SALE—Eico oscilloscope, model 425, perfect, $35; battery eliminator, ATR, type 610 Elib., good as new, $25; tube tester, Superior Instruments, 450 A with chart, good cond., $20. Ralph E. Johnson, 3 Washington Pl., Cranford, N. J.

FOR SALE—Hickok sweep generator model 610A, hardly used, $140; Dumont scope model 274A, slightly used, $70. Both instruments excellent. N. Kulke, 19620 Pasnow Ave., Euclid 19, Ohio.

FOR SALE—Eico scope model 425, $25; Hickok signal gen., model 288X, $100; N.R.I. Resist-Cond. Tester, $20; Western VOM No. 772 analyzer, $30. Robert M. Martin, Box Q, Umatilla, Fla.

SELL OR TRADE—Rider Manuals Nos. 1, 2, 3, 4, 5, 6, 8, 9, for Heath O-6 oscilloscope or equivalent, or a late model signal generator. Also have multitesters, meters, tubes, radio parts, text books, etc. G. F. Roby, 6137 Wentworth Ave., Chicago 21, Ill.

WANTED—Instructograph, AC model in good condition, with tapes. Will pay cash or trade test equipment and standard radio and TV parts. H. C. Barker, RFD 329, Foxboro, Mass.

FOR SALE—RCA Rider Chanalyst, with all cables and instruction book, like new condition, $99.50 f.o.b. $20 down, bal. c.o.d. George W. Ross, 3505 Townsend Dr., Fort Worth 10, Texas.

FOR SALE—Dumont type 148 oscilloscope, complete with instructions and diagram. Needs some tubes, cathode-ray tube, line cord, otherwise in good condition. Best cash offer. William P. Henninger, 51 N. Market St., Elizabethville, Pa.

WANTED—Glass dial scale for Belmont radio model 778 series B. George W. Weaver, Box 92, Saxton, Pa.

WANTED TO BUY—Six P.A. amplifiers, 6 to 60 watts power, late models only. Sell or trade two 20" Parabolic speakers, 1 Atlas mike stand. All never used. Urban C. Thobe, 345 Claranna Ave., Dayton 9, Ohio.

SALE OR TRADE—Set of 77 crystals, 1/2" pin spacing, frequency 5706 to 8340 kc. in approximate 32 kc. steps. Crystals were used in Army SCR 522 V.H.F. sets. R. Bebow, 1033 Hampton Rd., Sacramento 19, California.

SELL—Precision E-200-C sig. gen.; Weston 0-150V output meter; unmounted phono motors; tubes; Ham xtals; solder irons; transformers; Audak professional pick-up arm; etc. R. D. Driver, 102 Fairway Dr., Huntsville, Alabama.

WANTED—Dynamotors, Tubes, receivers or transmitters, junction boxes, jack boxes, control boxes, etc. We buy surplus. What have you? Tom Allen, 562 Atlantic Ave., Brooklyn 17, N. Y.

SWAP—10W homemade Hi-Fi amplifier with separate base and treble controls and 12" Jensen speaker for Master Addresser machine. Have 35mm Perfex Deluxe camera, shutter needs repair, swap for audio osc. Albert Sturm, 89-47 198th St., Hollis, N. Y.

SALE OR SWAP—20,000 ohms-per-volt multimeter $24; pen-oscillator, $5; 6V battery eliminator-charger, $27. All excellent cond. Want 22 pistol or revolver, TS-5 stethoscope with probe. W. Siuta, 4011 Lawndale St., Detroit 10, Mich.

SWAP—16mm Eastman projector with 10 reels 24 sound records. Also 8mm projector, ultra-violet ray lamp, phonographs, German tubes and parts, etc. Want radio and TV test equip., Riders above 15. Wm. F. O'Brien, 3928 1/2 So. Harvard Blvd., Los Angeles 37, Calif.

FOR SALE—12 1/2" Garod 27 tube set with 16" magnifier, $125; three 10" name brand picture tubes, $20 each. Also other TV sets and parts. O'Malley TV, 1601 William St., McKeesport, Pa.

WANTED—6-J4 tubes, grid dipper, "LM" instruction manual, capacitor bridge, audio signal gen., hearing aid tubes. Have cash, transformers, and relays. Louis Sciez, 1864 Welwyn, Des Plaines, Illinois.

FOR SALE—Rider Manuals, abridged vols. 1-5, and vols. 6-16, complete with indexes and theory booklets. A-1 condition, $125 f.o.b. Boston. B. R. Nelson, 35-B Tremont St., Malden 48, Mass.

FOR SALE—Hallicrafter HT-I transmitter, complete with tubes, push button operation, 50 watts output 10-20-40, phone CW. Also SX-28 and surplus ARR/5 Hi-Freq. receiver. Make offer. f.o.b. Los Angeles. Harold A. Darata, 3216 West 132 St., Hawthorne, Calif.

FOR SALE—Presto dual speed 13" turntable, overhead feed, hysteresis motor; Presto mike preamplifier, 200 ohm; Presto recording amplifier, 200 ohm. Tip-top condition. Each in separate case. All three, $360. Gerson D. Bender, 3451 Stocker St., Los Angeles 8, Calif.

SWAP—For Supreme Radio Manuals 1939, 47, 48, 49, 50, 51. Atwater Kent, Crosley, Arvin, Emerson, Fada, Fairbanks Morse, G.E., Majestic, Philco, RCA, Stewart-Warner, Delco, Wells Gardner, Zenith. James Morse, Rt. 2, Box 85, Hammon, Oklahoma.

FOR SALE OR SWAP—810's, 813's — transformers, condensers, meters, chokes, etc. Want complete mobile equipment. What do you have? R. V. Rosellin, 2619 So. Gaylord, Denver, Colo.

FOR SALE—Radionic Equipment Co. sig. gen. model A-100 has 6 RF bands. Two 10" Philco table model 48-1000; NRI VTVM tester; 1/16 h.p. motor. Best offer. Andrew J. Snincsak, 934 Lamberton St., Trenton, N. J.

FOR SALE—Newly invented Telephone antenna for AM receivers. $1 ea. postpaid. Send for details. Dealers inquiries invited. John Comstock, Wellsboro, Pa.

FOR SALE—Heathkit S.G. vernier tuning, $10; G.I. R90L, $15; 630 chassis completely wired in working order, no tubes, $40; two 5BP1, $3 ea.; Heathkit scope, $30. Marlin L. Bowser, 777 Huber St., Johnstown, Pa.

FOR SALE OR TRADE—Jewell model 199 set analyzer in good cond. Want National 1-10 receiver; good L-C-R bridge. C. E. Junkins, Jr., RFD 1, Box 272 Holyoke, Mass.

FOR SALE—Howard FM adaptor, 7 tube, excellent, model 482, $20 postpaid. Also Astatic TV booster model AT-1, $20 postpaid. Johnson Radio, 302 Oakwood St., Austin, Minn.

SELL OR SWAP—Sams Photofacts vol. 1 and 2. Also tubes. Want cash, accessories for 8mm Cine-Kodak magazine camera, or tape or wire recorder. J. G. Thum, 113-06 Blvd., Rockaway Beach, N. Y.

FOR SALE OR TRADE—Like new Hickok 209 Multimeter; McMurdo Silver 906 signal generator; Sam's Photofacts 1 thru 80 in volumes, 81 thru 98 in envelopes. Stanley A. Hatlestad, Bancroft, Iowa.

WILL TRADE—Dunlap 6-inch metal turning lathe with all gears, used only a few times, for all or part payment on Hickok 610-A sweep generator. McKinley's Radio Service, Zebulon, Ga.

FOR SALE—Clarkstan model 212 - 16" transcription arm, $12; Simpson model 260 VOM, $25; Webster Chicago model 156, $14. Also other items. E. F. Vanicek, 1265 Olmstead Ave., Bronx 61, N. Y.

FOR SALE OR SWAP—United Cinephone Corp. photoelectric control, complete with light source. Model 8327, worth $49.75, in perfect condition. Want 16MM. camera, sound film, movie equipment, etc. P. C. Crump, Box 96, Needles, Cal.

FOR SALE—Television stabilizer. My personally devised new type clarifier that improves picture reception. Try it 10 days. If not satisfied, return it undamaged and price will be refunded. Introductory price $10. J. G. Rountree, PO Box 408, Beeville, Tex.

FOR SALE—Astatic AT-1 TV-FM Booster in perfect condition $20. Heathkit Tube checker, latest tube chart and manual, also perfect, $20. Geo. A. Kester, Box 267, Ansonia, Ohio.

FOR SALE—Supreme tube, set and battery tester Model 504B. Good shape, used very little. $60.00. Approved Electronic Instrument Signal Generator model A-200. New, $35. Jack F. Younkman, 12937 Kerr St., Wyandotte, Mich.

SELL OR TRADE — Portable, AC power plant, gas-powered, 115 VAC, 1,000 watt output. Has built-in 12 VDC starting motor, 15 VDC output for battery charging. Will accept cash or what have you? Will ship. Eugene Rhodes, 6909 Spruce, Kansas City, Mo.

FOR SALE—Precision signal generator series E200. Excellent cond., also Rider's Manuals Nos: 4 to 13 with index, all in excellent cond. Make offer for all. Sherman Radio, 1205 W. 21st St., Sioux Falls, S. Dakota.

FOR SALE—Superior signal generator No. 650A, also Superior tube tester 450A. Fine cond., like new. Both $50. C. A. Sheller, 16676 Liberty St., San Leandro, Calif.

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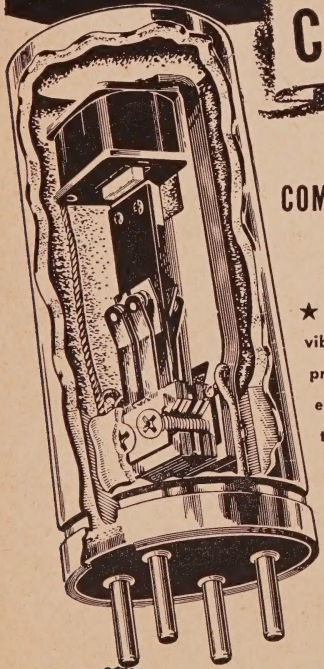

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